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Fertilizers for Carnations

By DAVID LUMSDEN

NEW HAMPSHIRE COLLEGE
OF
AGRICULTURE AND THE MECHANIC ARTS
DURHAM, NEW HAMPSHIRE

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FERTILIZERS FOR CARNATIONS

By David Lumsden

The commercial importance of the carnation as a florist's flower has been well explained in books and articles in magazines published at various times by writers and admirers of the carnation, the divine flower.

It is not my intention in this bulletin to write or explain anything pertaining to the origin and early history of the carnation plant or to give explicit directions regarding its culture and care. However, a few words at this time explanatory of the great importance of the industry will appeal to those who are interested in the culture of the flower, as it will convey to the reader some idea of the magnitude this industry has attained during the last few years.

Upwards of ten million carnation plants are annually grown, and upwards of one hundred and twenty million carnation blooms, per annum, are cut and sold in the various markets of the United States and Canada. The flowers are estimated as selling at an average of four dollars per hundred or $4,800,000 for the annual output.

The writer, being familiar with the amount of capital invested in carnation culture, considered it of importance to make a study of the economic production of first grade flowers by carrying on an experiment with fertilizers, to ascertain if possible their relative value when applied as top dressings to carnation plants grown on raised benches in the greenhouses; at the same time to determine the difference in the keeping quality of flowers raised under the various treatments given.

There are so many ways of applying fertilizer to the soil that the quantity to be given is very problematical. In field culture when fertilizer is sown with the seeds, the quantity used is much less than the quantity which is necessary when the whole ground is to be fertilized. Experience has taught us that chemical manures, which are rapidly soluble, should not be put in much below the surface, because by watering (if in the greenhouse)

or by rains (if in the field) they will be washed down quite low enough. Therefore with this knowledge the fertilizers were applied as top dressings in preference to being mixed with the compost when the benches were filled. The reader will note in all our experiments with the fertilizers that comparatively small quantities were used applied at frequent intervals (every three weeks) rather than heavier applications applied with longer intervals between dates.

The plants upon which we relied in our study of the fertilizers were seedlings raised at the New Hampshire College greenhouses, the progeny of such commercial varieties as Enchantress, Queen, M. A. Patten, Harry Fenn, Lady Bountiful, Mrs. T. W. Lawson, and Governor Wolcott.

The carnation plants used were propagated in the usual manner from cuttings taken December, 1907, and January, 1908. They were planted in the field on May 18th, 1908, the soil having been previously ploughed, harrowed and worked up to a soft mellow condition. The summer was somewhat dry and no water was given the plants whilst in the field. The ground was kept well cultivated, the loose soil acting as a mulch which assisted greatly in conserving moisture in the soil. The plants were gone over every two weeks and all shoots that were in proper condition for stopping were broken off. On September the tenth and eleventh the plants were lifted from the field and planted in the greenhouses on raised benches, in soil 6 inches deep. The loam used was composted the previous fall in the following manner: sods were taken from an old pasture field and piled up in alternate layers of sods and cow manure, in the proportion of one-fifth manure to four-fifths sods.

Plants were placed a foot apart each way in the benches and after planting were staked or trellized in the usual manner. Occasionally the hard crust formed on the surface of the soil was broken by shallow cultivation, a hand weeder being used for the operation. When the buds commenced to show, disbudding was resorted to, the surplus buds and side shoots being removed weekly. Watering was carefully attended to and the plants given all attention possible to promote growth. The temperature of the houses was kept at 52° F. during the night and 65°–70° F. during the day.

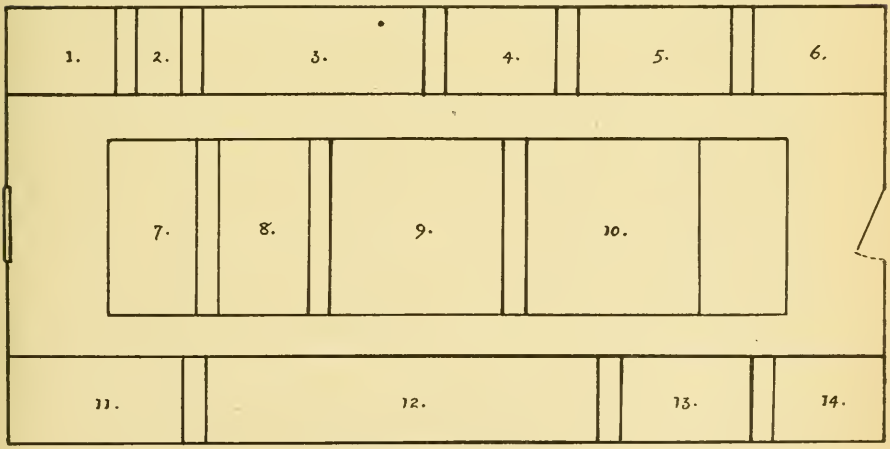
The varieties were arranged in blocks in different parts of the houses, in order that comparisons could be made regarding the action of the different fertilizers on each variety. Check plots containing plants of each variety were arranged to ascertain the difference in growth where no fertilizer or manure was applied.

The following fertilizers and manures were used in this experiment:

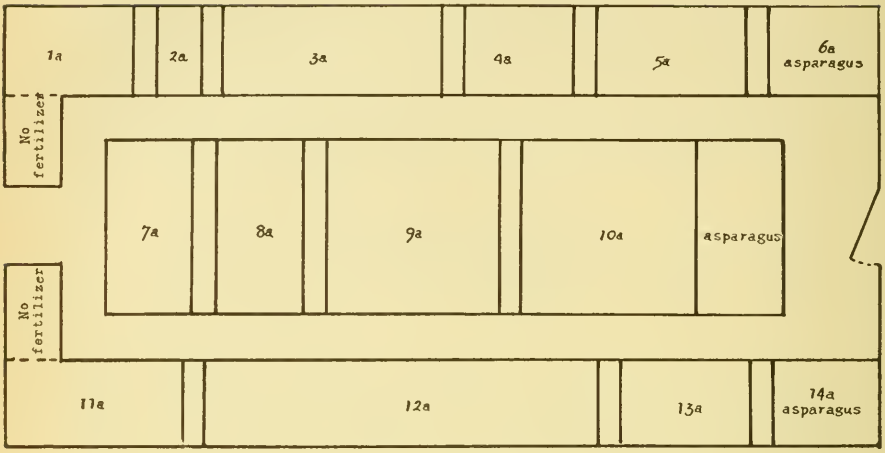
Nitrate of Soda
Muriate of Potash
Bone (Ground)
Clay's Fertilizer
Hen Manure.

All these fertilizers and manures were applied as top dressings to the surface of the plots every three weeks during the winter months, the first application being given November 3d, 1908; the last, April 20th, 1909. Nine applications were made covering a period of twenty-four weeks. The soil was stirred slightly, previous to applying the fertilizers; the fertilizer was carefully and evenly applied over the surface of the plots, and carefully watered into the soil with the hose.

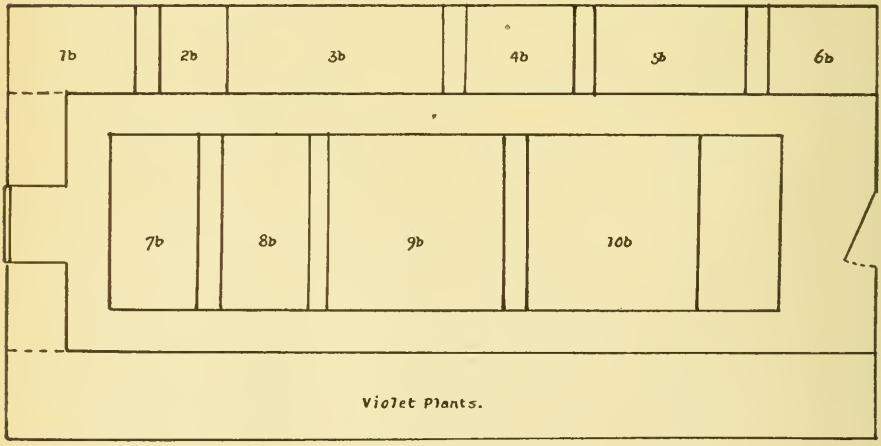
We have prepared charts of the greenhouses which will show the relative position of the various benches and plots, the benches being divided into sections and numbered consecutively. (See Charts 1, 2 and 3).



House No. 1.—Chart No. 1.
Plots fertilized as per list on page 7.



House No. 2.—Chart No. 2.
Plots fertilized as per list on page 7.



House No. 3.—Chart No. 3.
Check plots; no fertilizer applied.

The following table shows the kinds and amounts of fertilizers applied to the various plots in houses No. 1 and No. 2:

Plot No.	Bed No.	Ozs. per Application.	No. of Applications.	Total ozs. applied.	Area of Plot Sq. ft.	Fertilizer
1	1	$2\frac{1}{2}$	8	20	20	Clay's Fertilizer
2	1	1	8	8	8	Muriate of Potash
3	1	$3\frac{1}{2}$	8	28	40	Nitrate of Soda
4	1	$2\frac{1}{2}$	8	20	20	Bone Meal
5	1	8	8	64	28	Hen Manure
6	1	16	8	128	24	Hen Manure
7	2	8	8	64	32	Hen Manure
8	2	8	8	64	32	Bone Meal
9	2	16	8	128	64	Muriate of Potash
10	2	16	8	128	64	Clay's Fertilizer
11	3	7	8	56	32	Bone Meal
12	3	19	8	152	72	Clay's Fertilizer
13	3	6	8	48	24	Muriate of Potash
14	3	6	8	48	20	Clay's Fertilizer

The applications of fertilizers and manure were made on following dates: Nov. 3, Dec. 15, Jan. 5, Jan. 26, Feb. 16, March 9, March 30 and April 20.

Notes were made at intervals throughout the season and these records, summarized, are presented, as follows plot by plot.

Plots No. 1. and 1a.

Each of these plots contained 20 plants, 20 sq. ft. of soil and received 1 oz. Clay's fertilizer per sq. ft.

Nov. 3. The first top dressing of fertilizer was applied.

Dec. 15. A marked improvement was noticeable in growth over plants in check plot not receiving any fertilizer.

Jan. 5. A still greater improvement was noticeable. Root action could be seen extending over the entire surface of this section.

Jan. 26. The flowers produced at this time have long stiff stems. Calices shows no sign of bursting. Full crop now on.

Feb. 16. Plants have made very vigorous growth and are strong and healthy. Color of foliage, deep green.

March 9. Improvement was now very marked all over the plots treated with other fertilizers and manure.

March 30. Plants in a very vigorous and healthy condition. Another heavy crop of flowers just coming on.

April 20. This plot in full crop again. Flowers large; stems stiff and long. Keeping qualities excellent.

Plots No. 2 and 2a.

Each of these plots contained 8 plants, 8 sq. ft. of soil and received 1 oz. of muriate of potash per sq. ft.

Nov. 3. The first top dressing was applied. The plants in this plot were equal in strength and vigor to any in the various plots.

Dec. 15. This fertilizer was different in action to other fertilizers and manures applied, root action taking place two inches below the surface of the soil and not near the surface as with Clay's fertilizer, bone meal and nitrate of soda.

Jan. 5. Growth was not so marked as in other plots at this date. Plants had not increased much in size.

Jan. 26. Notes taken at this date prove the fertilizer to be somewhat slow in action.

Feb. 16. Plants show a stocky growth; flowers however, are not advancing so fast as in other plots.

March 9. At this date the plants are falling behind other plots in vigor and particularly length of stem.

March 30. No material changes can be noted at the date except that foliage had a very deep green color.

April 20. At this date the crop was off; plants however, were healthy and green.

Plots No. 3 and 3a.

Each of these plots contained 40 plants, 40 sq. ft. of soil and received 0.7 oz. of nitrate of soda per sq. ft.

Nov. 3. The first application was made.

Dec. 15. A slight improvement was noticeable in the growth of the plants. Growth, however, was somewhat weak.

Jan. 5. The plants have made considerable growth since the last notes were taken but the growth made is thin and lacking in strength.

Jan. 26. This bed is now in full crop. Flowers are somewhat papery. Stems long and rather weak.

Feb. 16. Root action is noticeable over the entire surface of the bed; there is also a slight improvement in the strength of the flower stems, perhaps owing to the better sunlight.

March 9. Plants do not show any marked gain at this time except in length of foliage and flower stems which are weak.

March 30. Flowers gathered are somewhat papery which impairs their keeping qualities, otherwise the flowers are large in size.

April 20. Plants are healthy and vigorous but have not the strength of plants in other plots treated with other fertilizers.

Plots No. 4 and 4a.

Each of these plots contained 20 plants, 20 sq. ft. of soil and received 1 oz. bone meal per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Root action was very prominent; there was also a decided improvement in the length of stem of the flowers.

Jan. 5. Further improvement was very noticeable, the color of foliage assuming a deep green appearance. Flowers were much larger and carried on stiff stems.

Jan. 26. Full crop on at this time. The flowers are solid. Calices shows no sign of bursting.

Feb. 16. Plants are in the pink of condition. Stems very long and stiff. Flowers first class.

March 9. Crop is off. Foilage is healthy. Deep green. Plants making a very good growth.

March 30. Notes taken at this date bear testimony of the value of bone meal to the carnation flower, as the plants are vigorous and healthy and the second crop of flowers is just coming on.

April 20. Flowers at this time bear out remarks at previous note taking. Flowers are large and firm, supported on stiff stem. Keeping qualities, excellent.

Plots No. 5 and 5a.

Each of these plots contained 28 plants, 28 sq. ft. of soil and received 2.28 oz. hen manure per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Root action noticeable over entire surface of bed.

Jan. 5. Color of foliage is deep green. Buds pushing rapidly.

Jan. 26. This plot is now at its best. The flowers are large but somewhat papery and stems are somewhat weak.

Feb. 16. Improvement is now noticeable in the length and strength of stems.

March 9. Plants are very healthy and the second crop of flowe s is showing.

March 30. Plants healthy. Flowers large, stems long, somewhat weak.

April 20. Notes taken at this ime confirm the previous notes. Plants are very healthy and vigorous, but lack in firmness and strength, both in foliage and stems.

Plot No. 6.

This plot contained 24 plants, 24 sq. ft. of soil and received 5.33 ozs. hen manure per sq. ft.

Nov. 3. The first application was made.

Dec. 15. Improvement noticeable over plants not treated with any fertilizer or manure.

Jan. 5. Vigorous growth is being made, but bed is showing signs of excess of fertilizer.

Jan. 26. Crop is on at this time, flowers are large, but very papery; do not keep well.

Feb. 16. Plants are in active growth. Stems very weak.

March 9. A slight improvement is noticeable, perhaps on account of more sunlight. The stems of flowers have more substance.

March 30. Crop off. Foliage tall but weak.

April 20. Notes taken at this date show Plot No. 5 where one half the quantity of manure was applied to 28 sq. ft. of bench space to be more vigorous than this plot, owing to the excess of nitrogen in the manure causing too weak a growth.

Plots No. 7 and 7a.

Each of these plots contained 32 plants, 32 sq. ft. of soil and received 2 ozs. hen manure mixed with 8 ozs. screened loam, per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Root action was noticeable all over the surface of plot.

Jan. 5. Plants improving in size; strength of stems improved.

Jan. 26. Flowers cut from the plot have long stems, somewhat weak. Flowers do not keep well.

Feb. 16. Slight improvement noticeable in length and strength of stem.

March 9. This plot is now in full crop. Flowers large. Foliage green and healthy.

March 30. Comparing this plot with Plots No. 1 and No. 2, the plants are not so strong. Stems are much weaker and plants are not so uniform in the plot.

April 20. Color of old foliage dark green, new growth light green. Stems of flowers somewhat weak and do not support the flowers well.

Plots No. 8 and 8a.

Each of these plots contained 32 plants, 32 sq. ft. of soil, and received 2 ozs. bone meal mixed with 8 ozs. screened loam per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Improvement noticeable; flowers are developing larger in size than on the plots that have received no dressings of fertilizers or manures.

Jan. 5. Foliage very dark green, plants show a marked improvement. Root action greatly increased.

Jan. 26. Root action very marked over the entire surface of the beds. Crop coming along rapidly. Stems stiff and strong.

Feb. 16. Plot at its best, growth is strong, stems long and stiff, flowers large size, calyx strong.

March 9. Foliage dark green, plants strong, healthy and upright, flowers large and keeping qualities excellent.

March 30. Plants continue to gain in strength and flowers produced are of the best quality.

April 20. This plot shows increased growth; surface root action is very prominent; plants vigorous and upright. General appearance of plot excellent.

Plots No. 9. and 9a.

Each of these plots contained 64 plants, 64 sq. ft. of soil, and received 2 ozs. muriate of potash mixed with 8 ozs. screened loam per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Plants improving very slowly over sections not fertilized.

Jan. 5. A slight improvement is noticeable.

Jan. 26. Plants are improving, but somewhat slowly and by no means uniformly.

Feb. 16. The plots are now carrying a crop of flowers; stems of flowers are short and the flowers are not large in size.

March 9. Improvement is noticeable over last notetaking, but improvement is by no means as marked as where other fertilizers were applied.

March 30. The improvement of plants in this plot is not marked, but they appear to be holding their own in regard to growth and color of foliage.

April 20. Plants present a fair appearance, are healthy, rather dwarf, and somewhat uneven.

Plots 10 and 10a.

Each of these plots contained 64 plants, 64 sq. ft. of soil and received 2 ozs. Clay's fertilizer mixed with 8 ozs. screened loam per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Foliage deep green. Plants vigorous, dense in growth, stems wiry and strong, 20 inches in length.

Jan. 5. Great improvement is now manifest, plants are vigorous, stems stiff, calices strong, flowers large size.

Jan. 26. Plots in full crop, flowers large, supported on stiff stems.

Feb. 16. The plants are making very vigorous growth and are still supporting a large crop of flowers.

March 9. Plants are very vigorous in growth. Foliage deep green, stems long and stiff, buds large.

March 30. The flowers produced at this time are very large, supported on stiff stems.

April 20. Foliage deep green, plants strong, healthy and vigorous, blooms large and of excellent keeping quality.

Plots No. 11. and 11a.

Each of these plots contained 32 plants, 32 sq. ft. of soil, and received 1.75 ozs. bone meal per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Improvement scarcely noticeable at this date.

Jan. 5. Plants now show a marked improvement. Buds are commencing to push and show color, supported on strong stems.

Jan. 26. Foliage deep green, plants very bushy and vigorous; stems are now 24 inches in length supporting large flowers with strong calices.

Feb. 16. The growth and length of stem still continue; plants very thrifty.

March 9. Foliage very dark green, root action very marked; crop heavy; length of flower stems 26 inches, heavy and strong.

March 30. The plants are very vigorous and flowers produced are large and of excellent keeping quality.

April 20. Plants healthy and vigorous. Flowers large, supported on stiff wiry stems.

Plots No. 12 and 12a.

Each of these plots contained 72 plants, 72 sq. ft. of soil and received 2.11 ozs. Clay's fertilizer per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Root action showing on surface of soil; plants show an improved appearance.

Jan. 5. Root action on surface increased; growth erect; color of foliage deep green.

Jan. 26. Much new growth noticeable at this date; the stems of flowers are long and stiff; flowers of large size; calices strong.

Feb. 16. Plants strong and bushy, vigorous and healthy; stems long, strong and upright. Blooms large. Keeping quality excellent.

March 9. Plants still show signs of heavy growth and improvement. Flowers very large, supported on strong stems.

March 30. At this date the stems of the flowers are lengthening out, 22-25 inches. Foliage dark green.

April 20. Plants are very healthy, supporting a heavy crop of first class flowers.

Plots No. 13 and 13a.

Each of these plots contained 24 plants, 24 sq. ft. of soil and received 2 ozs. muriate of potash per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. No marked improvement is noticeable at this time.

Jan. 5. Slight improvement noticeable. Root action showing on surface of plots. Growth of plants erect.

Jan. 26. Root action on surface of plots vastly increased; plants are more vigorous and crop of flowers is just coming on.

Feb. 16. Plot much improved in general appearance; crop now being cut; length of stems does not compare with plants treated with other fertilizers; habit of plant is somewhat dwarf.

March 9. Plants still show a little improvement.

March 30. Foliage dark green, plants strong and vigorous, but dwarf.

April 20. Flowers cut are good in quality, stems are however, short; keeping qualities fair.

Plot No. 14.

This plot contained 20 plants, 20 sq. ft. of soil and received 2.4 ozs. Clay's fertilizer with 10 ozs. screened loam per sq. ft.

Nov. 3. The first top dressing was applied.

Dec. 15. Beds show great improvement; crop of buds carried is now coming along rapidly; color of foliage deep green; habit of plants excellent.

Jan. 5. These plots show great evenness of growth; length of flower stems 27 inches; flowers large size and of great substance.

Jan. 26. At this date the crop is nearly all off; plants are throwing up much grass or leafy growth.

Feb. 16. Plants very healthy and in vigorous growth.

March 9. Crop just coming on at this date. Foliage rich green; stems of flowers long and stiff, 30–33 inches in length.

March 30. Plants very vigorous; bloom large and solid; calices good. Keeping quality of flowers very good.

April 20. Plants are very strong and vigorous, have made excellent growth; flowers very large, of fine substance.

The chart shows the keeping qualities of flowers:

1. Where Nitrate of Soda was used.
2. Where Muriate of Potash was used.
3. Where Bone Meal was used.
4. Where Clay's Fertilizer was used.
5. Where Hen Manure was used.
6. Where No fertilizer was used.

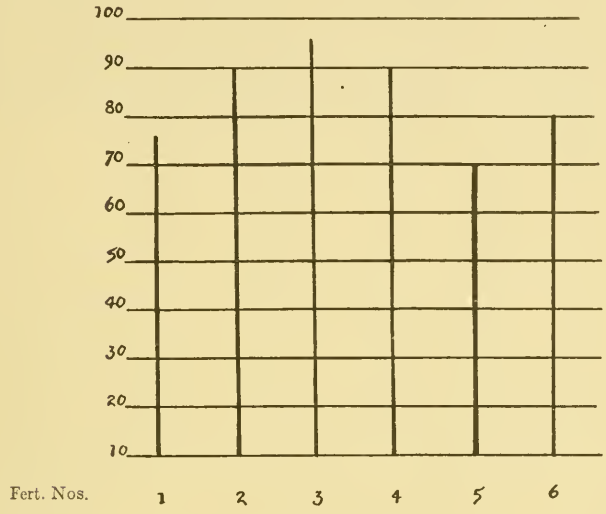


Chart No. 4.
Illustrating the relative keeping qualities of the flowers on a scale of 100.

SUMMARY.

From the data collected we find bone meal to give the best all-round results. The action of this fertilizer was much slower than nitrate of soda or other nitrogenous manures, but the vigor of the plants and the keeping qualities of the flowers were markedly superior to the plots treated with other manures.

Clay's fertilizer proved a good second all-round fertilizer, the plants responding to the action of this manure more quickly than to bone meal alone. In keeping qualities the data show that those grown with Clay's fertilizer ranked second.

Hen manure proved a valuable manure when used in small quantities, but when used in excess it had a tendency to force

the plants quickly into a weak growth, and greatly impaired the keeping qualities of the flowers.

Muriate of potash did not compare favorably with either bone meal, Clay's fertilizer or hen manure. Results from the different plots treated with muriate of potash were not uniform. The keeping qualities of the flowers were, however, excellent.

Nitrate of soda appeared the least valuable of any of the fertilizers applied, although active growth of the plants was noticeable soon after this fertilizer was placed in the beds. The plants in plots treated with this fertilizer did not show as much vigor and stability as when other fertilizers were applied, and the keeping qualities of the flowers were not so good.

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